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GB 2239679 A GB 2195403 A GB 1241368 A
EP 0357984 A

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# (54) Cooled sealing strip for nozzle guide vane segments

(57) A sealing strip 22 for controlling leakage of high pressure cooling air between abutting adjacent nozzle guide vane segments in a gas turbine engine is formed from an elongate corrugated strip, in which each corrugation 32, 34 extends generally transversely with respect to the longitudinal axis of the strip. The edges of the strip may also be corrugated. The strip is positioned in a slot between adjacent vane segments to provide an effective interplatform seal therebetween. The slot is defined by corresponding recesses (20) (Fig 1) machined in the confronting surfaces of abutting platforms. The sealing strip is arranged within the slot such that each corrugation cooperates with at least one of the sidewalls of each recess to provide a passage for the flow of cooling air therebetween.

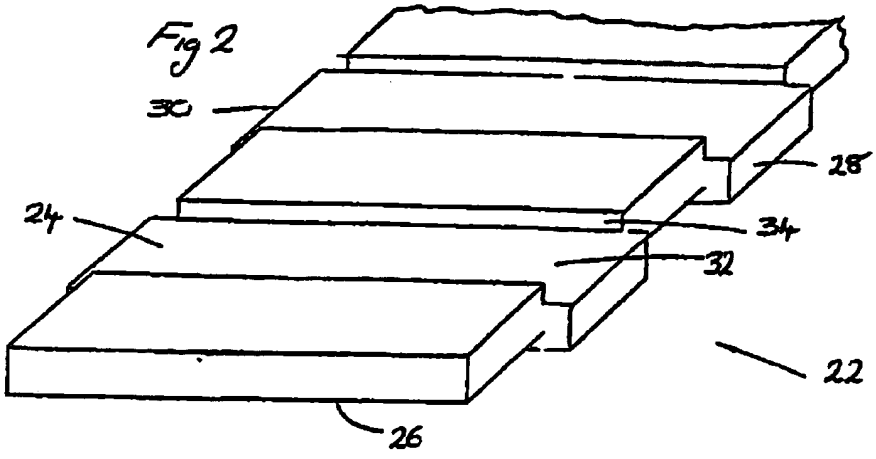


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Fig 1

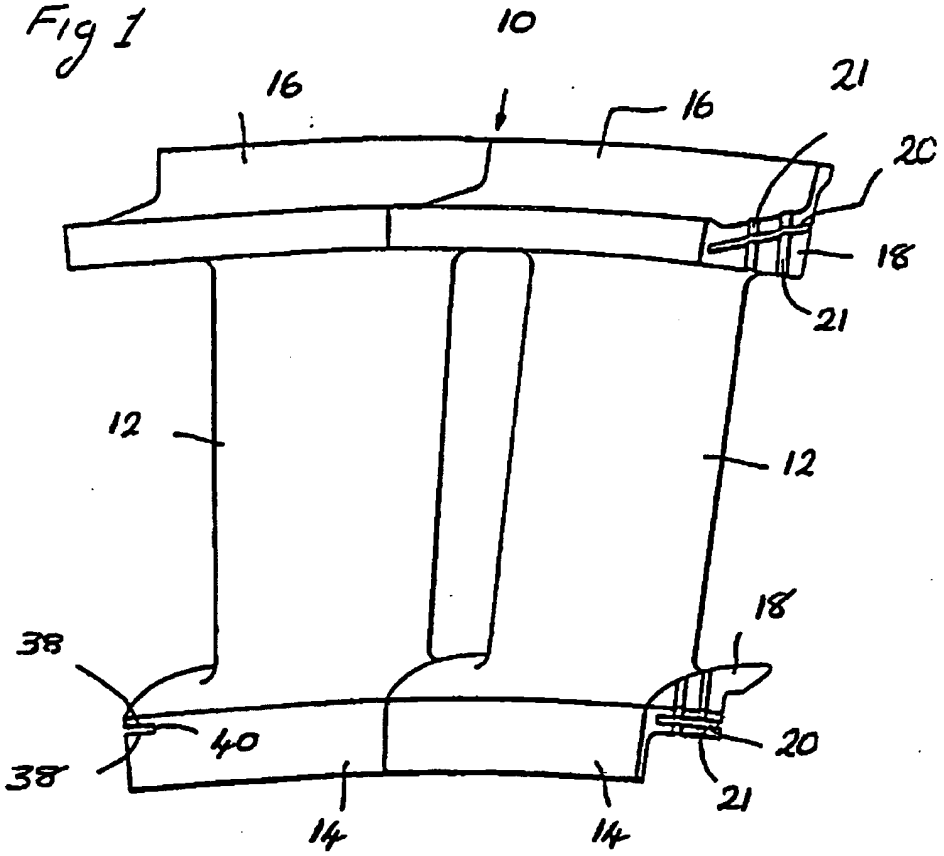



Fig 2

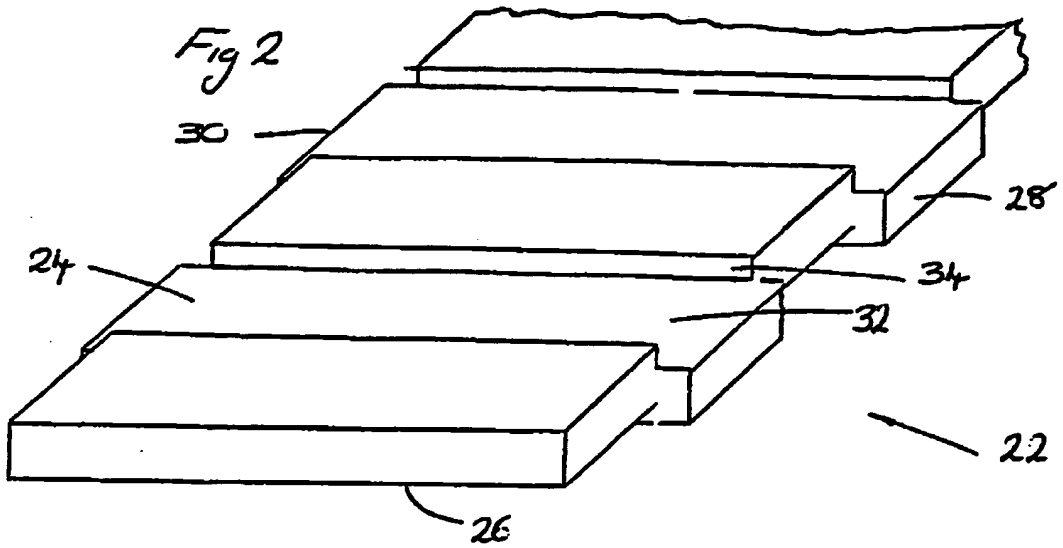


Fig 3

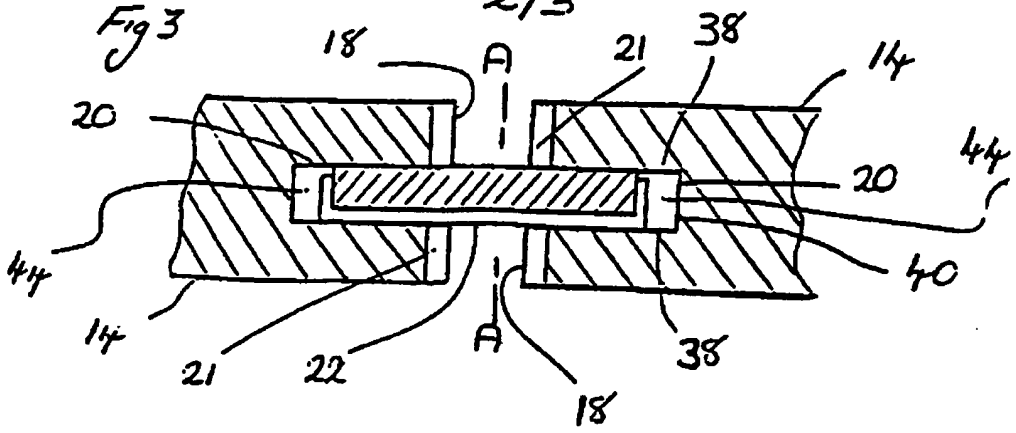



Fig 4

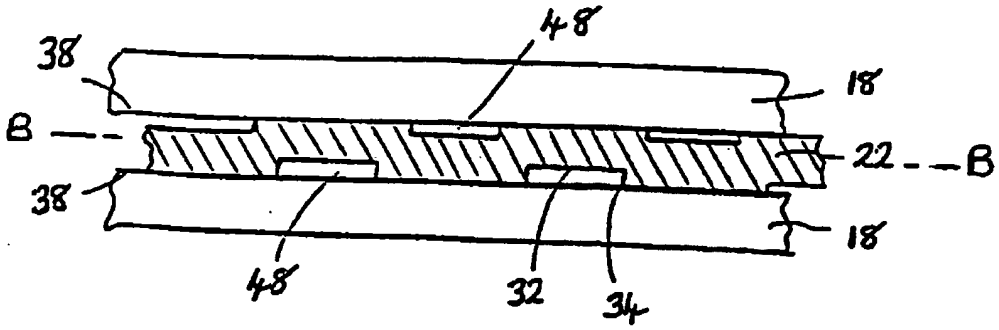
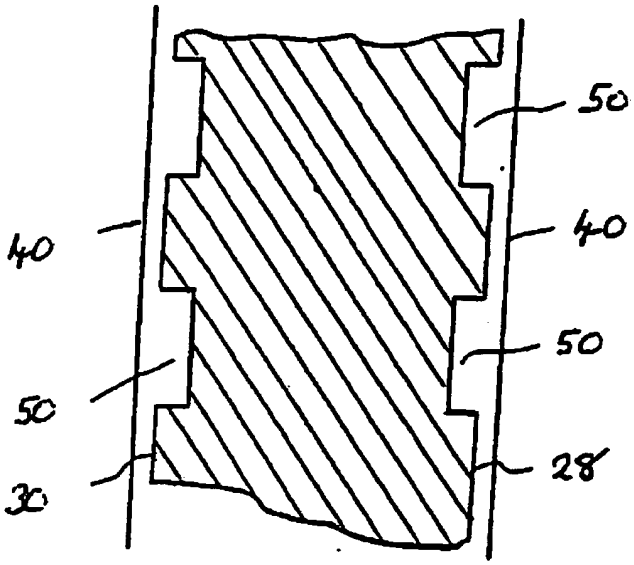



Fig 5



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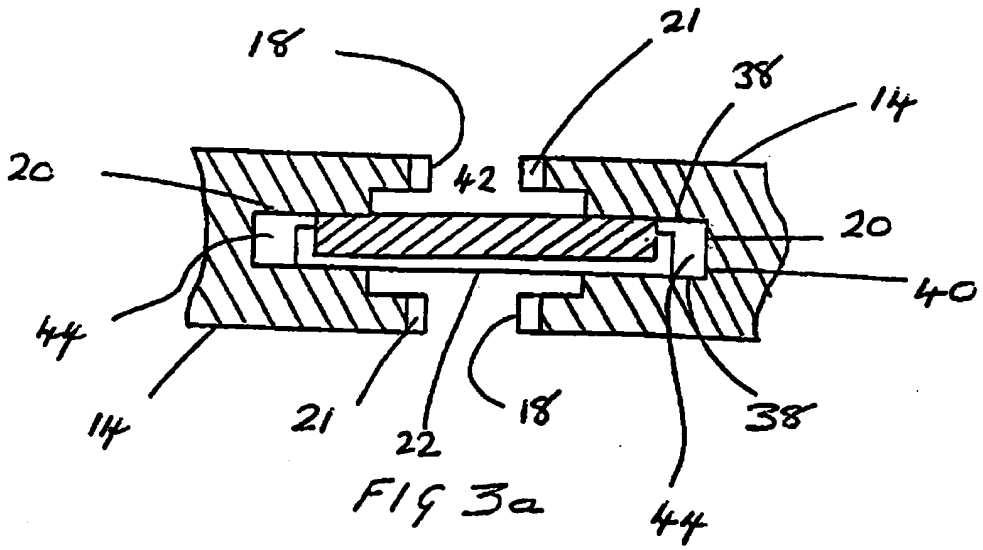


Fig 3a

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# IMPROVED COOLED SEALING STRIP

This invention relates to an improved cooled sealing strip for use between adjacent components, and in particular for use between adjacent blade and vane platforms in gas turbine engines.

It is necessary to provide an effective sealing means between adjacent blade and vane platforms in a gas turbine engine.

Conventionally, interplatform sealing arrangements comprising a flat sealing strip, which extends between adjacent platform members, have been used. In sealing arrangements of this type, the sealing strip is loosely located within a slot defined by confronting recesses machined in abutting surfaces of adjacent platforms. In use, the sealing strip is pressure loaded against the sidewalls of each recess to provide an effective interplatform seal therebetween.

Unfortunately, due to the presence of the seal, the elaborate cooling arrangements present in nozzle guide vane platforms become discontinuous at the platform edges. This discontinuity leads to a lower cooling effectiveness in that region, and ultimately to overheating of the adjacent vane platforms and the sealing strip.

Cooled interplatform sealing arrangements have been proposed to overcome this problem . One such arrangement is described in UK patent application GB 2,195,403 A, in which, the sealing strip is provided with a plurality of slots which allow a controlled leakage of high pressure cooling air. In use however, the slots give rise to a

less positive pressure load acting on the sealing strip. A cooled sealing strip of this type is therefore more susceptible to variations in flow and wear due to fluttering. Slotted sealing strips are also costly to manufacture.

The present inventions has for an objective to provide a simple cooled sealing arrangement between abutting platform members of adjacent nozzle guide vane segments.

Accordingly, it is an object of the present invention to provide a sealing member for use between adjacent components, wherein each of the components is provided with at least one side face having a recess which includes two opposed sidewalls and an internal end wall, each recess cooperates with a corresponding recess in an abutting side face of an adjacent component to form a slot for receiving the sealing member, the sealing member comprises an elongate member having transverse corrugations, whereby the sealing member is arranged in the slot such that each corrugation cooperates with the at least one of the sidewalls of each recess to provide a fluid flow passage therebetween.

The invention will now be described in greater detail with reference, by way of example only, to the accompanying drawings, in which:

Figure 1 is a schematic view of a nozzle guide vane segment;

Figure 2 is a schematic view of the sealing strip of the present invention;

Figure 3 is a section view of the sealing strip of Figure 2 in a first preferred embodiment;

Figure 3a is a section view of the sealing strip of Figure 2 in a second preferred embodiment.

Figure 4 is a section view in the direction of arrows A-A as shown in figure 3; and

Figure 5 is section view in the direction of arrows B-B as shown in figure 4.

A gas turbine engine (not shown) comprises a compressor, combustor, turbine, and nozzle section. In known arrangements the turbine section is provided with at least one stage for driving the compressor. Each stage of turbine has an annular array of nozzle guide vane segments for directing the gas flow onto a corresponding array of rotor blades.

Referring now to figure 1 a single nozzle guide vane segment 10 includes a pair of aerofoils 12, each of which extend between inner and outer arcuate platform members 14 and 16 respectively. Platforms 14 and 16 are provided with side faces 18 which abut a side face 18 of an adjacent vane. A recess 20 is machined in each side face 18 of each vane segment 10. Each recess 20,which may extend along the entire length of side face 18, comprises a pair of opposing sidewalls 38 and an endwall 40. Radial slots 21 may also be machined in each of the side faces such that they extend between opposing sides of the respective platform members.

Adjacent vanes segments 10 are arranged such that corresponding recesses 20 in abutting side faces 18 cooperate to define an axially extending slot therebetween for receiving a cooled sealing strip 22. A sealing strip 22 incorporating the features of the present invention is shown in Figure 2. The sealing

strip comprises an elongate flexible corrugated strip having a first and second side 24 and 26, and a pair of opposed edges 28 and 30. The corrugated surfaces 24 and 26 define a series of flow channels 32 and dividing walls 34, along the length of strip 22. Each corrugation, which may be square, sinusoidal or any other waveform, extends transversely with respect to the longitudinal axis of sealing strip 22. Alternatively each corrugation could extend between each of the edges 28 and 30 at some oblique angle. Preferably sealing strip 22 is also provided with corrugated edges 28 and 30 which are also continuous along the length of sealing strip 22.

The arrangement of sealing strip 22 between abutting inner platform members 14 will now be described with reference to Figures 3, 4, and 5. It will be appreciated that although Figures 3, 4, and 5 refer to the sealing arrangement between inner platforms 14, they are equally applicable to the sealing arrangement between outer platforms 16.

A sealing strip 22 is located in a slot defined between adjacent platforms 14. To provide for thermal expansion of the platform members 14 during engine operation a clearance 42 is introduced between the adjacent platforms. In the cold assembled state shown, this introduces further clearances 44 between side edges 28,30 and end walls 40. The fit between sealing strip 22 and sidewalls 38 may be interference, which, in use, would restrict movement of sealing strip 22 and consequentially reduce wear and flow variations. Sealing strip 22, which is flexible, could be inwardly compressed into the slot to provide the desired interference. Sealing strip 22 is arranged in the slot such that each corrugation extends between the adjacent

platforms 14, and cooperates with sidewalls 38 to form a fluid flow passage 48 therebetween.

In use inner platform members 14 on one side are exposed to high temperature low pressure (LP) fluid, and on the other side to a low temperature high pressure (HP) fluid. To effect cooling, the high pressure fluid acts upon surface 26 of sealing strip 22, and flows into each recess 20 via the fluid flow passages 48 defined on one side of sealing strip 22. The cooling fluid exits each recess 20 via a corresponding fluid flow passage 48 on the other side of sealing strip 22. The cooling fluid then flows into the region of the low pressure fluid. In use corrugated edges 28,30 prevent any potential blockage of the cooling flow in recess 20, which may otherwise occur as a result of sealing strip movement, by cooperating with endwalls 40 to define secondary fluid flow passages 50 therebetween. Similarly radial slots 21 prevent any potential cooling flow blockages which could otherwise occur as a result of thermal expansion of adjacent platforms 14 into abutting relationship.

In an alternative embodiment to that shown in Figure 3, Figure 3a shows a sealing strip of the present invention seated in a stepped recess 20a which is machined in each side face 18 of each platform. In this embodiment the stepped recess 20a provides for greater heat transfer in the region of the abutting side faces by virtue of the increased surface area.

## CLAIMS

1 A sealing member for use between adjacent components, wherein each of the components is provided with at least one side face having a recess which includes two opposed sidewalls and an internal end wall, each recess cooperates with a corresponding recess in an abutting side face of an adjacent component to form a slot for receiving the sealing member, the sealing member comprises an elongate member having transverse corrugations, whereby the sealing member is arranged in the slot such that each corrugation cooperates with the at least one of the sidewalls of each recess to provide a fluid flow passage therebetween.

2 A sealing member as claimed in claim 1 wherein the sealing member comprises an elongate strip having a first and second side and a pair of edges, and each of the sides is provided with at least one transverse corrugation extending between the edges.

3 A sealing member as claimed in claim 2 wherein the edges further comprise a corrugated profile.

4 A sealing member as claimed in any preceding claim wherein, a high pressure cooling fluid acts upon a first surface of the sealing member, passes through the passages defined therein, and exits on a second surface of the sealing member, cooling the sealing member and the abutting side faces of the adjacent components.

5 A sealing member as claimed in any preceding claim wherein the fit between the sidewalls of each recess and the sealing member is interference.

6 A sealing member as claimed in any preceding claim wherein each recess comprises a stepped profile.

7 A sealing member substantially as described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report) -8-

Application number
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**Relevant Technical fields**

(i) UK Cl (Edition L ) F1V (VCDD)

(ii) Int Cl (Edition 5 ) F01D

Search Examiner
C B VOSPER

**Databases** (see over)

(i) UK Patent Office

(ii)

Date of Search
8 SEPTEMBER 1993

Documents considered relevant following a search in respect of claims 1 TO 7

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|---|---|---|
| Y | GB 2239679 A (GENERAL) Figures 2 to 4 | 6 |
| X | GB 2195403 A (ROLLS-) whole document | 1 and 5 |
| Y | GB 2195403 A (ROLLS-) | 3 and 6 |
| X | GB 1241358 (WESTINGHOUSE) Figure 5 | 1 to 3 and 6 |
| X | EP 0357984 (WESTINGHOUSE) Figure 5 and Claim 1 | 1 and 2 |
| Y | EP 0357984 (WESTINGHOUSE) | 3 and 6 |

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| | | to claim(s) |
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